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The Scope of Modern Anesthetic Practice

KATE LESLIE, LARS I. ERIKSSON, JEANINE P. WIENER-KRONISH, NEAL H. COHEN, LEE A. FLEISHER, and MICHAEL A. GROPPER

KEY POINTS

- The scope of modern anesthesia practice includes preoperative evaluation and preparation; intraprocedural care; postoperative care including acute pain management; critical care, resuscitation, and retrieval; chronic pain management; and palliative care. Anesthesia plays a key role in health service delivery and has a significant impact on population health and the burden of disease.
- Global and national forces for change include changing patient populations, locations of care, workforce, costs, quality and safety initiatives, research capability, and the availability of data. These forces have major implications for the delivery of care, evaluation and organization of the anesthesia practice, and education and training of physician anesthesiologists.
- The volume of patients presenting for perioperative and obstetric care continues to grow. Increasingly more patients at extremes of age are requiring anesthesia services. Many of the patients are elderly and have significant comorbidities, including obesity and opioid use disorder. This has important implications for delivery of care and health system issues.
- Anesthesia care is shifting from the traditional surgical suite to other procedural areas, ambulatory sites, office-based facilities, and home environments. As anesthesia care expands, anesthesiologists must focus on maintaining the safety and quality of care in these diverse settings.
- Global and regional deficits in the availability of high-quality anesthesia care must be managed by improving the supply of both physician and non-physician anesthesia providers, by better use of technology, and by limiting demand through health promotion and disease prevention strategies.
- Internationally, the costs of health care continue to escalate; unfortunately the increased spending has not consistently translated into improved health outcomes. Health policy initiatives including alternative approaches to healthcare financing and payment systems are increasingly being implemented to encourage efficient and effective team-based anesthesia care.
- Anesthesiology was among the first medical specialties to focus on improving the safety of patient care. As anesthesia has become safer, attention has intensified on quality improvement, a process designed to improve patient experience and outcomes through systematic change and evaluation.
- Basic, translational, clinical, and implementation research is vital to continuous improvement in outcomes. Opportunities to optimize care are supported by the availability of large datasets generated using electronic health records as well as novel analytic techniques. These changes create new opportunities for anesthesiologists to collaborate with basic and translational scientists to better understand current practices and define better ways to deliver care. As always the provision of resources to support these research initiatives is a challenge.
- The scope of modern anesthetic practice is continually expanding and changing. The changes occurring in health care in the 21st century create opportunities for anesthesiologists to assume a broader role in clinical practice and health policy, providing exciting opportunities for the next generation of physicians in our specialty.

Introduction

Anesthesia is fundamental to the overall practice of medicine worldwide. Hundreds of millions of patients receive anesthesia care each year in association with a wide range of medical, surgical, and obstetric procedures. In addition to direct delivery of anesthesia to patients undergoing a surgical procedure, the scope of anesthesia practice extends beyond the traditional surgical suite to include preoperative evaluation and management of underlying clinical conditions (see Chapter 11); postoperative care including acute pain management (see Chapter 81); critical care, resuscitation, and retrieval (see Chapter 67); chronic pain management (see Chapter 51); and palliative care (see Chapter 52). Anesthesia therefore plays an essential role in health service delivery (see Chapter 3) and has a significant impact on global health and the burden of disease (see Chapter 2). The purpose of *Miller's Anesthesia* is to cover the full scope of

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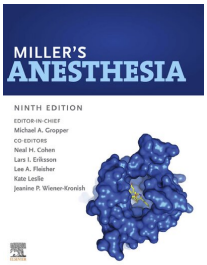

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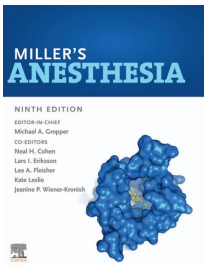

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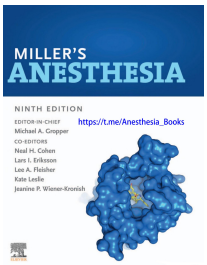

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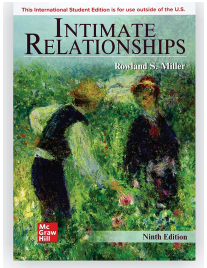

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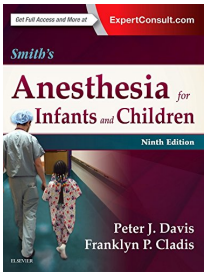

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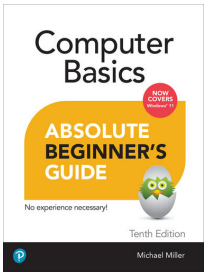

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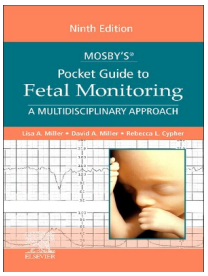

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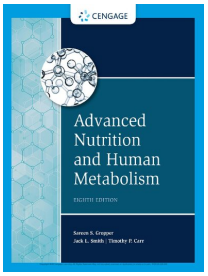

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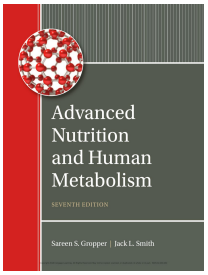

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contemporary anesthesia practice, from fundamental principles to advanced subspecialty procedures.

Every edition of this textbook begins with comments about the novel diagnostic and therapeutic procedures that have been developed since the last edition and the increasing complexity of patients presenting for anesthesia and perioperative care, especially those at the extremes of life. Each edition also provides descriptions about advances in anesthesiology that have facilitated patient care, including improved understanding of the processes that underlie disease and injury, the increasing sophistication of the pharmacologic and technical resources available, and the improvements in systems designed to promote safety and quality in health care. The 9th edition is no exception: in the last decade the advances in anesthesia and surgical care, especially for patients receiving complex clinical care, have been truly remarkable.

None of these advances would have been possible without the commitment of anesthesiologists to leadership, teaching, and research. Evidence of their contributions can be found in every chapter of the book, extending from improved understanding of the mechanisms of anesthesia and the processes that regulate organ function and drive organ failure; through new technologies, drugs, and systems of care and education; to improved understanding and acknowledgement of the critical role patients and their families play in decision making about healthcare and end-of-life issues.

The future of anesthesiology is filled with opportunities and challenges. Global and national forces will drive evidence-based, cost-effective perioperative and obstetric care by multiprofessional and multidisciplinary teams. These changes will be supported by integrated electronic medical records and large databases and registries of healthcare outputs and outcomes. Increasingly, anesthesia care has expanded outside the operating room, into preoperative clinics, intervention suites, extended postanesthesia care units, and even into patients' homes. As is true for other medical specialties, anesthesiologists have adopted telehealth strategies to extend the care provided to patients and colleagues beyond face-to-face encounters. Technological advances have and will continue to facilitate less invasive interventions and improved anesthesia delivery and monitoring systems. As a result, seriously ill and injured patients and those at the extremes of age, often with associated comorbidities now have access to care previously not available to them. Care is also becoming more personalized, in large part because of the availability of genetic testing and an improved understanding of the unique needs of each patient based on disease severity and his or her probability of responding to specific treatment modalities. Partially as a result of these improvements in care, the costs of caring for an aging population with progressively sophisticated therapies challenge all nations. These forces will likely have a major effect on the scope of perioperative care in general and anesthesia services in particular. Therefore, anesthesiologists must be involved in health policy decisions about the distribution of resources and the need for high-quality evidence to guide practice. In the rest of this chapter we will deal with some of these forces in detail.

Forces That Will Change Practice (Fig. 1.1)

CHANGING PATIENT POPULATIONS

The volume of patients having surgical procedures each year is large and growing. In 2012, more than 300 million patients had surgery worldwide.[1] This number probably underestimates the overall volume of patients requiring anesthesia services, in large part because much of anesthesia care is now provided outside of traditional surgical suite environments. Global initiatives aimed at delivering universal health coverage and safe and affordable surgery and anesthesia care will result in further increases in the number of patients requiring anesthesia care in coming decades (see Chapter 2).

Increasingly many of the patients requiring anesthesia services will be older and have multiple health problems, including obesity and chronic pain associated with opioid use.

The World Health Organization has estimated that by the year 2050 nearly one-quarter of the world's population will be over 60 years of age.[2] In the United States the number of people aged 65 years and over, and therefore eligible for treatment under Medicare, is expected to exceed 78 million by 2030. In high income countries the increase in the numbers of older patients will result from improved preventative care and management of chronic disease and injury. In low- and middle-income countries this change will result from improvements in maternal and child health and the eradication or control of infectious diseases. Concurrently, improvements in anesthetic and surgical care in many countries are increasing medical care options for older patients, who are now receiving more surgical services—many complicated procedures—than ever before. However, the accessibility of these additional options is presenting new challenges for both patients and providers. Aging is associated with a decline in physiologic reserve and organ function and an increase in the risk of disease, injury, and disability (both physical and cognitive). The aging process is highly variable, with significant influence from genetic, environmental, and societal factors. Aging is also associated with considerable changes in social and economic circumstances. Overall these factors lead the older adult to greater dependence on health and social care and challenges in the provision of safe surgery and anesthesia (see Chapters 65 and 82).

One significant public health issue that is accelerating internationally is obesity. It has emerged as a global health epidemic. In 2016, 39% of adults and 18% of children and adolescents worldwide were overweight.[3] In the United States the prevalence of overweight populations was 67.9% and 41.8% in adults and children, respectively. Although the rate of increase in the number of overweight and obese populations have slowed in some high-income nations, this is not the case in low- and middle-income countries. Poor access to healthy diets and limited exercise contribute to the problem. Obesity is associated with an increased burden of disease and injury, including diabetes and hypertension that result in the need for more interactions with the health system, high costs, and significant challenges in the provision of safe and high-quality surgical and anesthetic care (see Chapter 58).

Fig. 1.1 Changing scope and settings of anesthesia and perioperative medicine. (A) *The Cure of Folly,* by Hieronymus Bosch (c.1450–1516), depicting the removal of stones in the head, thought to be a cure for madness. (B) Friedrich Esmarch amputating with the use of anesthesia and antisepsis. (C) Harvey Cushing performing an operation. The Harvey Cushing Society is observing (1932). (D) Placement of a deep brain stimulator for the treatment of Parkinson disease using a real-time magnetic resonance (MR) imaging technology (MR fluoroscopy). The procedure occurs in the MR suite of the radiology department. The patient is anesthetized and (E) moved into the bore of the magnet. (F) A sterile field is created for intracranial instrumentation, and (G) electrodes are placed using real-time guidance. (A, Museo Nacional del Prado, Madrid. B, Woodcut from Esmarch's *Handbuch Der Kriegschirurgischen Technik* [1877]; Jeremy Norman & Co. C, Photograph by Richard Upjohn Light (Boston Medical Library). D to G, Courtesy Paul Larson, University of California–San Francisco, San Francisco Veterans Administration Medical Center.)

Pain management strategies have also had impact on anesthesia practice and perioperative care. The current opioid epidemic arose from increased prescription of opioid drugs to treat all types of acute and chronic pain, including postoperative pain. This crisis has been exacerbated by diversion of prescribed medication (i.e., diverting a medication from its original licit medical purpose) and use of "street" drugs, including opioids. The consequences are significant for individual patients and society as a whole. Opioid use has resulted in addiction, overdoses, homelessness, excessive emergency room visits, increased infections, and neonatal abstinence syndrome. The Centers for Disease Control and Prevention (CDC) estimated that more than 191 million prescriptions (58.7 prescriptions per 100 persons) were filled in the United States in 2017, with marked regional variation characterized with adverse physical, economic, and social circumstances.[4] Opioids were involved in 42,249 overdose deaths in 2016 (66.4% of all drug overdose deaths). The situation is similar in other nations, with the World Health Organization estimating that 27 million people worldwide suffered opioid use disorder in 2015.[5] Recent government action has been substantial, particularly in the United States. The Department of Health and Human Services has implemented a five-point plan to combat the crisis including: (1) improved access to prevention, treatment, and recovery support services; (2) targeted availability and distribution of overdose-reversing (narcotic antagonist) drugs; (3) strengthened public health data reporting and collection; (4) support for cutting-edge research on addiction and pain; and (5) advances in pain management practice.[6] As experts in the pharmacology and clinical use of opioid drugs (see Chapters 24, 51, and 81), anesthesiologists and pain medicine specialists have and must continue their essential role in resolving this crisis.

CHANGING LOCATIONS OF CARE

Anesthesia practice has expanded to a variety of locations. A number of factors account for this shift in anesthesia and perioperative care (see Chapter 73). The costs of traditional operating room care are high and the services available may be unnecessarily comprehensive and complex for the planned episode of care. With advances in clinical care, the need for inpatient perioperative care is reduced for many surgical procedures. As a result more and more procedures are being performed in hospital outpatient settings, ambulatory surgery centers, and office-based practices. The focus of accrediting bodies and anesthesiology societies has been on maintaining the safety and quality of anesthesia care in outpatient settings, including providing for extended admission and escalation of care when clinically necessary to ensure patient safety.[7] At the same time, the payment models have not necessarily kept pace with these advances in clinical care. In the United States, the growth in

nonhospital-based care has occurred despite curbs in reimbursement for ambulatory surgery by governmental and private payers.

The clinical practice for surgical patients has also changed because of changes in sites of care and inpatient management. For most patients, many aspects of perioperative care have shifted from the hospital or other healthcare facility to outpatient or home settings. As one example, the elimination of preoperative hospital admission to day-of-surgery admission is virtually complete in high-income nations. Hospital lengths of stay are also much shorter. As a result, postoperative care is increasingly undertaken in the home as well, often as part of enhanced recovery after surgery programs.[8] Advances in monitoring technology and pain management techniques create opportunities for anesthesiologists in which to not only participate, but also manage many aspects of postoperative care in the home. Although these changes have been beneficial to many patients with improved outcomes and reduced costs, for some families the transition to short hospital lengths of stay has created significant clinical and social problems. Anesthesiologists must have an understanding of patients perioperative and postoperative support needs and should be actively engaged in determining the most appropriate setting for a procedure and how to manage the transitions of care.[9]

In addition to the changes taking place for surgical patients, anesthesia care is also shifting outside the operating room as a result of the advances in minimally invasive techniques provided by cardiologists, radiologists, endoscopists, and pain medicine specialists (see Chapters 51, 55, 57, and 73). As the volume of these services increases, anesthesiologists may be asked to provide care in procedural areas that were not designed for delivery of anesthesia services, and often not properly equipped to support patient and provider needs. The locations are frequently remote from the operating suite and may lack the usual support available for the care of patients with complex cases and the management of crises. Anesthesiologists therefore must participate in planning for these services and provide leadership in defining and maintaining the same standards of operating room practice to other areas of the hospital.[10,11]

Another example of the advances in clinical care and implications is the remarkable increase in referrals for colonoscopy for colon cancer screening.[12] Although the sedation provider for colonoscopy widely varies internationally and regionally within the United States, anesthesiologists are now more commonly participating in the care of these patients, in part due to medical needs related to comorbidities, but also because of documented complications associated with the use of sedation that have resulted in airway compromise or respiratory failure. These complications have caused providers and payers to reevaluate patient needs, the appropriate training of practitioners delivering procedural sedation, and when to optimize care by having an anesthesia practitioner monitor the patient and administer sedation. American[11,13] and international[14,15] sedation guidelines recognize that for many patients, nonanesthesiologist physicians and independent or semi-independent nonmedical practitioners can provide deep sedation for endoscopy; however, all guidelines emphasize that anesthesiologists should be involved in the care of high-risk patients or those with significant comorbidities.

CHANGES IN THE ANESTHESIA WORKFORCE

As a result of advances in perioperative care and the many other changes that impact the need for anesthesia practitioners, global and regional workforce shortages have been identified in recent years and are expected to increase (see Chapter 2). There are a number of reasons for these deficits including an insufficient number of medical graduates (in some places exacerbated by outward migration and an aging workforce), duty hour restrictions for practicing physicians (due to regulation of work hours, changing lifestyle preferences, and desire for better work-life balance), and increased demand for medical services (due to population growth and on a per capita basis). In addition to the impact of these societal changes, demand for physician care in the United States has increased in part due to the Patient Protection and Affordable Care Act (Affordable Care Act) with more patients having medical insurance and seeking care. To respond to the shortages, many countries within the Organisation for Economic Co-operation and Development (there are 36 member countries, including the United States) have increased medical school admissions in recent years.[16] Unfortunately, even this increase in number of trainees is insufficient to meet future needs. In 2017, the United States produced 7.55 medical graduates per 100,000 population, well below average (12 per 100,000 inhabitants). The Association of American Medical Colleges (AAMC) projects a shortage of up to 121,000 physicians by 2030.[14] At the same time, despite the increases in medical student enrollment, in the United States, most residency positions are funded by the Medicare program. As the medical school intakes have increased, this federal funding for residency positions (including anesthesiology) has not kept pace resulting in a bottleneck in the training pipeline. Along with reconsidering the cap on federally-funded positions, the AAMC has proposed alternative ways to leverage the skills and experience of physicians to advance care with improved use of technology and more interdisciplinary, team-based care as potential solutions.

Team-based care (anesthesia care team model) is already common in anesthesia practice, particularly in the United States. In the United States, the number of physician and nonphysician anesthesia providers are approaching parity, with the number of nurse anesthetists and anesthesia assistants increasing more rapidly than the number of physician anesthesiologists. In 2017, the American Society of Anesthesiologists (ASA) released a statement on the anesthesia care team that enunciated its vision for physician-led teams where anesthesiologists have a particular role in governance, planning, and oversight of anesthesia care, advanced airway management, and resuscitation.[17] This oversight includes defining and monitoring sedation provided in non-operating room locations and other requirements for the credentialing of providers to optimize care of the patient who requires deep sedation. Similar team-based approaches to care associated with physician supervision are commonplace or emerging in other countries around the world.

The number of women in medical schools has increased to over 50% of the student cohort in many countries. At the same time, until recently, United States anesthesiology training programs have recruited a smaller proportion of

women (37%). In academic departments, few women have reached the rank of professor, or become department chairs, or been elected to leadership positions in representative anesthesia organizations.[18] Programs to improve recruitment and advancement of women in academic medicine and anesthesiology have gained traction in the last decade (e.g., Athena Scientific Women's Academic Network[19]). In addition, all academic programs are paying more attention to diversity in the workforce, particularly among women and underrepresented minorities. With the increased understanding of the inequities, programs can be developed to more effectively address the disparities and broaden the diversity of the anesthesia workforce. It is essential that the anesthesia workforce reflect the diversity of the patient population that is served.

INCREASING COSTS OF CARE

The costs of health care continue to grow internationally, with health care consuming 8% of gross domestic product (GDP) on average in most countries, whereas in the United States the costs are as high as 18% of GDP.[20] Unfortunately the increased healthcare expenditures have not translated into improved health outcomes, particularly for Americans. Despite the Affordable Care Act, the United States continues to have a large uninsured or underinsured population, lapses in quality and safety of care inside and outside the hospital, and high rates of drug abuse, violence, and use of firearms.[21] The National Academy of Medicine concluded that healthcare funding in the United States needs to "reorient competition in the healthcare system around the value of services provided rather than the volume of services provided." This transition from volume to value is creating many new challenges and opportunities for anesthesiologists. As the health system adopts practices that provide documented improved outcomes at reduced costs, anesthesiologists must both understand the implications of these changes in clinical practices and also take a leadership role in identifying opportunities to reengineer care if the specialty is to retain its leadership role in quality and safety (see Chapter 3).

Payment for physician services is being modified to better align health systems, providers, and payers with respect to delivery of high-quality, patient-centered care. Compensation for clinical care continues to have a fee-for-service component, particularly in the United States; however, more compensation is becoming incentive-based to encourage changes in practice that improve efficiency and effectiveness. In contrast to fee-for-service models (which reward inputs), pay-for-performance models reward medical care that is consistent with published evidence and that improves the processes of care (e.g., timely administration of perioperative antibiotics), output (e.g., meeting targets for urgent surgery), or outcome (e.g., fewer central-line associated blood stream infections) measures. In the United States, recent pay-for-performance programs have included the Premier Hospital Quality Incentive Demonstration program of the Centers for Medicare and Medicaid Services (2003–2009) and the national Hospital Value-Based Purchasing Program, adopted after the passage of the Affordable Care Act (2011). This initial attempt to modify anesthesia practice has had limited impact on outcomes, possibly because financial incentives are too small, payment is delayed, and/or the costs associated with implementing the programs is greater.[22] Nonetheless, incentive-based pay-for-performance programs (which are widespread in other nations with high-cost healthcare systems) will continue to expand.[23]

In addition to paying for high-quality performance, in the United States and other high-income nations there has been increasing emphasis on not paying for poor outcomes of errors in care. For example, some payers withhold payment for "never" events (e.g., wrong-sided surgery, pressure ulcers, retained foreign objects, mismatched blood transfusion) unless they are present on admission to the hospital. This approach may be expanded to withhold payment associated with treatment of preventable complications. A number of anesthesia-specific activities have been identified that impact outcomes and, if these are not provided, the consequence could be either no payment or penalties. For example, monitoring and maintaining body temperature during surgery as promoted by the Surgical Care Improvement Project is but one example of an anesthesia metric that affects outcomes and costs of care.[24] At the same time, identification of some of the interventions or monitoring techniques that impact outcome is challenging. As a result, it is critically important for anesthesiologists to continue to evaluate practices and do additional research to both optimize care and reduce costs.

Other changes in payment for clinical care have and will continue to have significant impact on compensation for anesthesia services. Some payers are providing "bundled" payments to compensate providers for episodes of care. This approach to payment is an integral part of the reforms introduced under the Affordable Care Act, although some of the incentives may be redefined by subsequent legislation. The Bundled Payments for Care Improvement initiative introduced by the Centers for Medicare and Medicaid Services tested the ability of bundling payments as a method for improving quality and lowering costs. The program has been most successful for selected clinical services such as total joint arthroplasty for which participation by anesthesiologists through the continuum of care can be most significant.[25] The ASA has proposed the Perioperative Surgical Home as an anesthesiologist-managed structure to coordinate perioperative team-based care. This model of coordinated care throughout the perioperative period should be amenable to bundled payments or other new approaches to compensating providers.[26]

INCREASING FOCUS ON SAFETY AND QUALITY

Anesthesiology was among the first medical specialties to focus on improving patient safety.[27] A number of initiatives have had major impact on outcomes of care, including improved monitoring techniques, airway management options, and new improved drugs. Anesthesiologists have been actively assessing clinical care through the use of incident reporting systems, morbidity and mortality conferences, and "near-miss" reports. Incident reporting, which was initiated in the United States more than 50 years ago, has documented a decline in anesthesia-related mortality to less than 1 per 1 million population.[28] In recent years national incident reporting programs have been initiated

by the Anesthesia Quality Institute (Anesthesia Incident Reporting System[29]) and the Society of Pediatric Anesthesia (Wake Up Safe[30]). In addition to helping identify areas in which to improve clinical care, these programs provide legal protection to practitioners under the Patient Safety and Quality Improvement Act (2005). A number of programs have developed based on the experiences identified through these reporting mechanisms. Recognition of the human factors associated with adverse events has spawned a national and international movement directed at improving situational awareness and team functioning through simulation training (see Chapter 6). More recently programs to encourage healthcare providers and consumers to speak up about traditional patient safety concerns (e.g., commencing a wrong-side procedure) and unsafe professional behaviors (e.g., bullying and sexual harassment) have been integrated into workplaces nationwide and internationally.[31]

Anesthesiologists also led the way in the development of practice standards and checklists to improve clinical care. In some cases, the implementation of checklists has become a requirement for accreditation. In the last decade anesthesiologists were pivotal in the development, implementation, and evaluation of the World Health Organization's Surgical Safety Checklist.[32] Although the uptake of the Checklist has been patchy and its effect on outcomes has been inconsistent, the Checklist is widely implemented in the United States and other countries (see Chapter 2) in the belief that it will enable effective communication and a culture of safety.[33]

As anesthesia has become more and more safe, our attention has increasingly been focused on quality improvement, a process designed to improve patient experience and outcomes through systematic change and evaluation. In the United States, the Anesthesia Quality Institute established the National Anesthesia Clinical Outcomes Registry to enable systematic collection of quality information for use in quality improvement processes both nationally and locally.[34] Recently greater emphasis has been placed on longer-term and patient-centered or patient-reported outcomes. Many of these outcome measures have been incorporated into quality improvement programs and publicly reported metrics.[35] Anesthesiologists have identified the importance of assessing outcomes beyond the immediate perioperative period. As anesthesiologists assume a greater role in overall periprocedural care and outcomes, they will undoubtedly continue to advance the safety and quality agenda in large part due to their longstanding history in safety and quality as well as their training and pivotal role in perioperative care.

NEW OPPORTUNITIES AND CHALLENGES IN RESEARCH

Academic anesthesia departments are committed to advancing the scientific underpinning of anesthesiology. Basic, translational, clinical, and implementation research is vital to the continuous improvement in patient and health service outcomes (see Chapter 89). Fortunately, overall funding for biomedical and health services research in the United States more than doubled between 1994 and 2012. Although overall research funding has increased, since 2004 the overall growth of NIH funding for medical research has declined by 1.8%.[36] Private sources of funding have been important to supplement government-sponsored research support. Industry support is valuable and has been critical to the research agenda for academic departments. It also creates both real and perceived conflicts of interest that can be difficult to manage. Over the past decade, there has been a decline in early-stage research in favor of device development and clinical trials, poor mapping of research effort to the global burden of disease, and limited funding for critically important health services research.[36]

The implications of these changes in research support on anesthesia are significant. Academic anesthesia departments in the United States, as well as many other countries, continue to compete for government funding. Most benchmarks suggest that the specialty of anesthesiology in the United States fares poorly in National Institutes of Health funding when compared with other disciplines.[37] As a result, anesthesia departments, particularly in the United States have had to identify other funding sources, including foundations, industry, and philanthropy, particularly for early-career investigators.[38] For example the Foundation for Anesthesia Education and Research (FAER) has awarded more than $40 million in grants since 1986 and has demonstrated the leverage that these grants provide in achieving federal funding ($17 in funding for every $1 investment). Similar programs are funded by the International Anesthesia Research Society and by other anesthesiology organizations and foundations worldwide. At the same time, and in many respects related to the funding challenges and competing clinical needs, research support and peer-reviewed publications, which have increased in other countries, have not kept pace in the United States. As a result, an increasing number of publications in peer-reviewed journals are from authors outside the United States.

Other factors have impact on what resources are available for research. The clinical demands put on the faculty in academic departments make it difficult for clinician scientists to pursue research activities. Associated with the increasing clinical volume, supervised residents cannot provide all of the clinical care without compromising their educational experiences and fulfilling duty hour and other requirements. As a result, the faculty members are delivering a larger percentage of care on their own. At the same time, the complexity of some of the basic and translational research requires significant dedicated time and skills that are difficult to maintain when the investigator is also encumbered with a high clinical demand. Historically, clinically generated income was used to support research in general and young investigators in particular. As labor and other costs increase (including those associated with quality of care initiatives, clinical and research compliance, and other activities), fewer funds are available to support research. As a result of the high cost of developing new drugs with insufficient incentives for the pharmaceutical industry to develop new anesthetic agents, there is a reduced pipeline of anesthesia drugs.[39]

Despite these challenges, basic science, as well as clinical and translational research, is being performed by anesthesiologists and advances in the specialty are taking place. New models for research have contributed to advances in

our understanding of basic concepts of anesthesia care as well as clinical advances. As is true for clinical care, collaboration has always been vital in biomedical research. In recent years anesthesiology research has increasingly been conducted by multiprofessional, multidisciplinary teams including biostatisticians, health informaticians, and health economists. Translation from discovery to practice has been facilitated by partnerships among basic scientists, clinical scientists, and implementation scientists.[40] In addition to collaborations among colleagues within one institution, increasingly clinical trials are being conducted by large, multicenter networks because of the recognition that single-center studies take too long and cannot recruit enough patients to answer the really important questions in anesthesiology.[41-44] Research based on electronic medical records and databases also requires collaboration between institutions, clinicians, and database experts (see later).

One of the primary motivators to support the research agenda for anesthesiology is the need to define reliable and peer-reviewed data upon which to advance the specialty. Although the volume of anesthesiology information and its ease of access have increased exponentially in the last decade, particularly through social media, anesthesiologists are progressively challenged to find reliable information to guide their practice. In addition to the difficulty of assessing the quality of some of the information posted on various web sites, anesthesiology has also been plagued by high-profile cases of research misconduct, including fabrication, falsification, and misleading reporting of research findings.[45] This has damaged the reputation of anesthesiology research and, as a result of unreliable data upon which to make clinical decisions, put patients at risk. Each anesthesiologist must be diligent in selecting a source of information that takes into consideration the standards of peer review of the material and the financial relationships between the authors and publishers.[46]

INCREASING AVAILABILITY OF DATA

One of the areas of opportunity with respect to better understanding our clinical practices and defining ways to improve care is the increasing amount of data that can inform us. The last decade has seen unprecedented growth in the volume and availability of healthcare data. Electronic health record (EHR) systems (see Chapter 4) facilitate complete data capture and integration from multiple sources, including surgical equipment, anesthesia delivery systems, and physiologic monitors. The EHR has greatly facilitated documentation of individual patient care and provided aggregate data for healthcare services and populations. Other sources of routinely-collected data include health service billing systems, government and insurance databases, disease registries, and public health reporting. In addition, data specifically collected for research and quality improvement is increasingly shared, including research databases and biobanks (including genetic databanks). Meta-data related to the use of electronic resources and social media is also available for interrogation. These data require new management and analysis techniques that are beyond the scope of the practicing anesthesiologist or researcher (see Chapter 4). Truly "big" data includes terabytes of information, is generated and analyzed at high speed, and includes data in a wide variety of formats and from a wide variety of sources.[47]

These large data sets are increasingly being used to answer important research questions, to develop evidence-based clinical guidelines, and to assess the safety and quality of anesthesia and perioperative care, within and across different clinical environments and regions. Although technologic resources are not replacing randomized clinical trials, the information gleaned from large databases can be used to address important questions about how to most effectively deliver cost-effective care. At the same time, it is important to acknowledge the limitations of large databases, which may have missing critical elements of care or outcomes, could misclassify data, or in some cases, lack verification.[48]

Conclusions

The scope of modern anesthetic practice is continually changing and expanding. The forces for change include changes in our patient population, locations of care, workforce, costs, quality and safety initiatives, research, and the availability of data. This chapter emphasizes the implications for these forces on the specialty as well as the influence they have on the delivery of health care in general. The changes occurring in health care in the 21st century obviously have implications for the role of anesthesiology in both the practice and delivery of medicine overall, and provide exciting opportunities for the next generation of practitioners and leaders in our specialty.

Acknowledgment

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Complete references available online at expertconsult.com.

References

1. Weiser TG, et al. *Lancet*. 2015;385(suppl 2):S11.
2. World Health Organisation. World report on ageing and health. Geneva. https://www.who.int/ageing/events/world-report-2015-launch/en/. Accessed October 18 2018.
3. World Health Organisation. Fact sheet on overweight and obesity. http://www.who.int/en/news-room/fact-sheets/detail/obesity-and-overweight. Accessed October 18 2018.
4. Centers for Disease Control and Prevention. U.S. opioid prescribing rate maps. Atlanta. https://www.cdc.gov/drugoverdose/maps/rxrate-maps.html. Accessed October 18 2018.
5. World Health Organisation. Information sheet on opioid overdose. Geneva. http://www.who.int/substance_abuse/information-sheet/en/. Accessed October 18 2018.
6. Department of Health and Human Services. Help, resources and information. National opioid crisis. Washington. https://www.hhs.gov/opioids/. Accessed October 18 2018.
7. American Society of Anesthesiologists. Guidelines for office-based anesthesia. Schaumberg. https://www.asahq.org/quality-and-practice-management/standards-guidelines-and-related-resources-search. Accessed October 18 2018.
8. Kehlet H. *Br J Anaesth*. 1997;78:606.
9. Fleisher LA, et al. *Arch Surg*. 2004;139:67.
10. American Society of Anesthesiologists. Statement on non-operating room anesthetizing locations. Schaumberg. https://www.asahq.org/quality-and-practice-management/standards-guidelines-and-related-resources-search. Accessed.

11. American Society of Anesthesiologists task force on moderate procedural sedation and analgesia. *Anesthesiology*. 2018;128:437.
12. National Cancer Institute. Colorectal cancer screening. Bethesda. https://progressreport.cancer.gov/detection/colorectal_cancer. Accessed October 18 2018.
13. Quality Management and Departmental Administration Committee. Advisory on granting privileges for deep sedation to non-anesthesiologist physicians (amended October 25, 2017). Schaumburg. http://www.asahq.org/quality-and-practice-management/standards-guidelines-and-related-resources. Accessed March 5 2018.
14. The Academy of Medical Royal Colleges. Safe sedation practice for healthcare procedures. London. https://www.rcoa.ac.uk/system/files/PUB-SafeSedPrac2013.pdf. Accessed March 5 2018.
15. Hinkelbein J, et al. *Eur J Anaesthesiol*. 2017;35:6.
16. Organisation for Economic Co-operation and Development. Medical graduates. Paris. https://data.oecd.org/healthres/medical-graduates.htm. Accessed October 18 2018.
17. American Society of Anesthesiologists. Statement on the anesthesia care team. Schaumberg. http://www.asahq.org/quality-and-practice-management/standards-guidelines-and-related-resources/statement-on-anesthesia-care-team. Accessed October 18 2018.
18. Leslie K, et al. *Anesth Analg*. 2017;124:1394.
19. Equality Challenge Unit. Athena SWAN Charter. London. https://www.ecu.ac.uk/equality-charters/athena-swan/. Accessed October 18 2018.
20. Organisation for Economic Co-operation and Development. Health spending. Paris. https://data.oecd.org/healthres/health-spending.htm. Accessed October 18 2018.
21. National Research Council and Institute of Medicine. U.S. *Health in International Perspective: shorter Lives, Poorer Health*. Washington: National Academies Press. 2013.
22. Bonfrer I, et al. *BMJ*. 2018;360:j5622.
23. European Observatory on Health Systems and Policies. Paying for performance in healthcare. Implications for health system performance and accountability. Maidenhead. http://www.euro.who.int/__data/assets/pdf_file/0020/271073/Paying-for-Performance-in-Health-Care.pdf. Accessed October 18 2018.
24. Scott AV, et al. *Anesthesiology*. 2015;123:116.
25. Centers for Medicare & Medicaid Services. Bundled Payments for Care Improvement (BPCI) Initiative: General Information. Washington DC. https://innovation.cms.gov/initiatives/bundled-payments/. Accessed October 18 2018.
26. American Society of Anesthesiologists. Perioperative surgical home. Schaumberg. https://www.asahq.org/psh. Accessed October 18 2018.
27. Kohn L, Corrigan J, Donaldson M. *To Err Is Human: Building a Safer Health System*. Washington DC: National Academy Press; 1999.
28. Li G, et al. *Anesthesiology*. 2009;110:759.
29. Anesthesia Quality Institute. Anesthesia incident reporting system (AIRS). Schaumberg. https://qualityportal.aqihq.org/AIRSMain/AIRSSelectType/0. Accessed October 18 2018.
30. Society for Pediatric Anesthesia. Wake up safe. Richmond. http://www.wakeupsafe.org/. Accessed October 18 2018.
31. Webb LE, et al. *Jt Comm J Qual Patient Saf*. 2016;42:149.
32. Haynes A, et al. *N Engl J Med*. 2009;360:491.
33. de Jager E, et al. *World J Surg*. 2016;40:1842.
34. Liau A, et al. *Anesth Analg*. 2015;121:1604.
35. Peden CJ, et al. *Br J Anaesth*. 2017;119:i5.
36. Moses H 3rd, et al. *JAMA*. 2015;313:174.
37. Reves JG. *Anesthesiology*. 2007;106:826.
38. Speck RM, et al. *Anesth Analg*. 2018;126:2116.
39. Vlassakov KV, Kissin I. *Trends Pharmacol Sci*. 2016;37:344.
40. Kharasch ED. *Anesthesiology*. 2018;128:693.
41. Myles P, et al. *BMJ Open*. 2017;7:e015358.
42. Pearse RM, et al. *JAMA*. 2014;311:2181.
43. Wijeysundera DN, et al. *Lancet*. 2018;391:2631.
44. Devereaux P, et al. *N Engl J Med*. 2014;370:1494.
45. Moylan EC, Kowalczuk MK. *BMJ Open*. 2016;6:e012047.
46. Shen C, Bjork BC. *BMC Med*. 2015;13:230.
47. Levin MA, et al. *Anesth Analg*. 2015;121:1661.
48. Fleischut PM, et al. *Br J Anaesth*. 2013;111:532.

References

1. Weiser TG, Haynes AB, Molina G, et al. Estimate of the global volume of surgery in 2012: an assessment supporting improved health outcomes. *Lancet*. 2015;385(suppl 2):S11.
2. World Health Organisation. World report on ageing and health. Geneva. https://www.who.int/ageing/events/world-report-2015-launch/en/. Accessed October 18 2018.
3. World Health Organisation. Fact sheet on overweight and obesity. http://www.who.int/en/news-room/fact-sheets/detail/obesity-and-overweight. Accessed October 18 2018.
4. Centers for Disease Control and Prevention. U.S. opioid prescribing rate maps. Atlanta. https://www.cdc.gov/drugoverdose/maps/rxrate-maps.html. Accessed October 18 2018.
5. World Health Organisation. Information sheet on opioid overdose. Geneva. http://www.who.int/substance_abuse/information-sheet/en/. Accessed October 18 2018.
6. Department of Health and Human Services. Help, resources and information. National opioid crisis. Washington. https://www.hhs.gov/opioids/. Accessed October 18 2018.
7. American Society of Anesthesiologists. Guidelines for office-based anesthesia. Schaumberg. https://www.asahq.org/quality-and-practice-management/standards-guidelines-and-related-resources-search. Accessed October 18 2018.
8. Kehlet H. Multimodal approach to control postoperative pathophysiology and rehabilitation. *Br J Anaesth*. 1997;78:606–617.
9. Fleisher LA, Pasternak LR, Herbert R, Anderson GF. Inpatient hospital admission and death after outpatient surgery in elderly patients: importance of patient and system characteristics and location of care. *Arch Surg*. 2004;139:67–72.
10. American Society of Anesthesiologists. Statement on non-operating room anesthetizing locations. Schaumberg. https://www.asahq.org/quality-and-practice-management/standards-guidelines-and-related-resources-search. Accessed.
11. American Society of Anesthesiologists Task Force on Moderate Procedural Sedation and Analgesia, the American Association of Oral and Maxillofacial Surgeons, American College of Radiology, American Dental Association, American Society of Dentist Anesthesiologists, and Society of Interventional Radiology. Practice guidelines for moderate procedural sedation and analgesia 2018. *Anesthesiology*. 2018;128:437–479.
12. National Cancer Institute. Colorectal cancer screening. Bethesda. https://progressreport.cancer.gov/detection/colorectal_cancer. Accessed October 18 2018.
13. Quality Management and Departmental Administration Committee. Advisory on granting privileges for deep sedation to non-anesthesiologist physicians (amended October 25, 2017). Schaumburg. http://www.asahq.org/quality-and-practice-management/standards-guidelines-and-related-resources. Accessed March 5 2018.
14. The Academy of Medical Royal Colleges. Safe sedation practice for healthcare procedures. London. https://www.rcoa.ac.uk/system/files/PUB-SafeSedPrac2013.pdf. Accessed March 5 2018.
15. Hinkelbein J, Lamperti M, Akeson J, et al. European Society of Anaesthesiology and European Board of Anaesthesiology guidelines for procedural sedation and analgesia in adults. *Eur J Anaesthesiol*. 2017;35:6–24.
16. Organisation for Economic Co-operation and Development. Medical graduates. Paris. https://data.oecd.org/healthres/medical-graduates.htm. Accessed October 18 2018.
17. American Society of Anesthesiologists. Statement on the anesthesia care team. Schaumberg. http://www.asahq.org/quality-and-practice-management/standards-guidelines-and-related-resources/statement-on-anesthesia-care-team. Accessed October 18 2018.
18. Leslie K, Hopf HW, Houston P, O'Sullivan E. Women, minorities, and leadership in anesthesiology: Take the pledge. *Anesth Analg*. 2017;124:1394–1396.
19. Equality Challenge Unit. Athena SWAN Charter. London. https://www.ecu.ac.uk/equality-charters/athena-swan/. Accessed October 18 2018.
20. Organisation for Economic Co-operation and Development. Health spending. Paris. https://data.oecd.org/healthres/health-spending.htm. Accessed October 18 2018.
21. National Research Council and Institute of Medicine. U.S. health in international perspective: shorter lives, poorer health. Washington: National Academies Press; 2013.
22. Bonfrer I, Figueroa JF, Zheng J, Orav EJ, Jha AK. Impact of financial incentives on early and late adopters among us hospitals: Observational study. *BMJ*. 2018;360:j5622.
23. European Observatory on Health Systems and Policies. Paying for performance in healthcare. Implications for health system performance and accountability. Maidenhead. http://www.euro.who.int/__data/assets/pdf_file/0020/271073/Paying-for-Performance-in-Health-Care.pdf. Accessed October 18 2018.
24. Scott AV, Stonemetz JL, Wasey JO, et al. compliance with surgical care improvement project for body temperature management (SCIP Inf-10) is associated with improved clinical outcomes. *Anesthesiology*. 2015;123:116–125.
25. Centers for Medicare & Medicaid Services. Bundled Payments for Care Improvement (BPCI) Initiative: General Information. Washington DC. https://innovation.cms.gov/initiatives/bundled-payments/. Accessed October 18 2018.
26. American Society of Anesthesiologists. Perioperative surgical home. Schaumberg. https://www.asahq.org/psh. Accessed October 18 2018.
27. Kohn L, Corrigan J, Donaldson M. *To Err Is Human: Building a Safer Health System*. Washington DC: National Academy Press; 1999.
28. Li G, Warner M, Lang BH, Huang L, Sun LS. Epidemiology of anesthesia-related mortality in the United States, 1999-2005. *Anesthesiology*. 2009;110:759–765.
29. Anesthesia Quality Institute. Anesthesia incident reporting system (AIRS). Schaumberg. https://qualityportal.aqihq.org/AIRSMain/AIRSSelectType/0. Accessed October 18 2018.
30. Society for Pediatric Anesthesia. Wake up safe. Richmond. http://www.wakeupsafe.org/. Accessed October 18 2018
31. Webb LE, Dmochowski RR, Moore IN, et al. Using coworker observations to promote accountability for disrespectful and unsafe behaviors by physicians and advanced practice professionals. *Jt Comm J Qual Patient Saf*. 2016;42:149–164.
32. Haynes A, Weiser T, Berry W, et al. A surgical safety checklist to reduce morbidity and mortality in a global population. *N Engl J Med*. 2009;360:491–499.
33. de Jager E, McKenna C, Bartlett L, Gunnarsson R, Ho YH. Postoperative adverse events inconsistently improved by the World Health Organization Surgical Safety Checklist: a systematic literature review of 25 studies. *World J Surg*. 2016;40:1842–1858.
34. Liau A, Havidich JE, Onega T, Dutton RP. The National Anesthesia Clinical Outcomes Registry. *Anesth Analg*. 2015;121:1604–1610.
35. Peden CJ, Campbell M, Aggarwal G. Quality, safety, and outcomes in anaesthesia: what's to be done? An international perspective. *Br J Anaesth*. 2017;119:i5–i14.
36. Moses H 3rd, Matheson DH, Cairns-Smith S, George BP, Palisch C, Dorsey ER. The anatomy of medical research: US and international comparisons. *Jama*. 2015;313:174–189.
37. Reves JG. We are what we make: transforming research in anesthesiology: the 45th Rovenstine Lecture. *Anesthesiology*. 2007;106:826–835.
38. Speck RM, Ward DS, Fleisher LA. Academic anesthesiology career development: a mixed-methods evaluation of the role of Foundation for Anesthesiology Education and Research funding. *Anesth Analg*. 2018;126:2116–2122.
39. Vlassakov KV, Kissin I. Decline in the development of new anesthetics. *Trends Pharmacol Sci*. 2016;37:344–352.
40. Kharasch ED. The challenges of translation. *Anesthesiology*. 2018;128:693–696.
41. Myles P, Bellomo R, Corcoran T, et al. Restrictive versus liberal fluid therapy in major abdominal surgery (RELIEF): rationale and design for a multicentre randomised trial. *BMJ Open*. 2017;7:e015358.
42. Pearse RM, Harrison DA, MacDonald N, et al. Effect of a perioperative, cardiac output-guided hemodynamic therapy algorithm on outcomes following major gastrointestinal surgery: a randomized clinical trial and systematic review. *JAMA*. 2014;311:2181–2190.
43. Wijeysundera DN, Pearse RM, Shulman MA, et al. Assessment of functional capacity before major non-cardiac surgery: an international, prospective cohort study. *Lancet*. 2018;391:2631–2640.

44. Devereaux P, Sessler D, Mrkobrada M, et al. Aspirin in patients having non-cardiac surgery. *N Engl J Med*. 2014;370:1494–1503.
45. Moylan EC, Kowalczuk MK. Why articles are retracted: a retrospective cross-sectional study of retraction notices at BioMed Central. *BMJ Open*. 2016;6:e012047.
46. Shen C, Bjork BC. Predatory' open access: a longitudinal study of article volumes and market characteristics. *BMC Med*. 2015;13:230.
47. Levin MA, Wanderer JP, Ehrenfeld JM. Data, big data, and metadata in anesthesiology. *Anesth Analg*. 2015;121:1661–1667.
48. Fleischut PM, Mazumdar M, Memtsoudis SG. Perioperative database research: possibilities and pitfalls. *Br J Anaesth*. 2013;111:532–534.

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2 Anesthesia and Analgesia in the Global Context

MICHAEL S. LIPNICK, RONALD D. MILLER, and ADRIAN W. GELB, EDITORS.
SEE CHAPTER OUTLINE FOR CO-AUTHORS.

CHAPTER OUTLINE

Introduction
Section 1: Anesthesia and "Global Health"
Scope and Scale of the Global Anesthesia, Surgery, and Pain Crises
- Global Burden of Surgical Disease
- Global Burden of Pain
- Disparities in Access, Affordability, and Safety

Global Anesthesia, Surgery, and Pain Crises: Origins and Areas for Intervention
- Misperceptions and Limited Data
- Advocacy and Policy
- Workforce Shortages and Strategies for Expansion
- Infrastructure Challenges
- Inequities in Analgesia

Section 2: Evolution of Anesthesia Care Models and Challenges Around the World
Africa
- Uganda (Mary T. Nabukenya and Sarah Hodges)
- South Africa (Hyla Kluyts)

North America
- Canada (Tyler Law)
- Mexico (Gerardo Prieto)
- United States (Ronald D. Miller and Adrian W. Gelb)

Europe
- Norway (Jannicke Mellin-Olsen)
- Romania (Daniela Filipescu)

Asia and The Middle East
- India (Bala Krishnan Kanni)
- Lebanon and The Middle East (Patricia Yazbeck)
- Pakistan (Fauzia Khan)
- China (Yugaung Huang)
- Vietnam (Thi Thanh Nguyen and Thang Cong Quyet)

South America
- Paraguay (Rodrigo Sosa Argana)
- Colombia (Pedro Ibarra)

Oceania
- Australia and New Zealand (Rob McDougall) Fiji and Pacific Island Nations(Sereima Bale)

Section 3: Essentials for Practice in Resource-Constrained Settings
Clinical and Technical Skills
- Personnel
- Equipment
- Drugs
- Patients

Global Health Competencies
Conclusions

KEY POINTS

- More than 5 of the world's 7 billion people lack access to safe anesthesia and surgical services. Surgical disease accounts for 30% of global disease burden, yet less than 1% of development assistance for health supports delivery of anesthesia and surgical care. Lack of access to safe, timely, and affordable anesthesia and surgery kills more than 4 times as many as acquired immunodeficiency syndrome (AIDS), tuberculosis (TB), and malaria combined.
- Lack of access to safe anesthesia and surgical services are among the most neglected crises in global health. Anesthesia-related mortality in some low-income countries (LICs) is reported in the 1:100s and is mostly avoidable. The burden of surgical disease is growing and disproportionately affects low- and middle-income countries.
- Pain is one of the top causes of morbidity worldwide, and inadequate access to analgesia is among the most inequitable global public health crises the world faces today. Five and a half billion people have limited or no access to narcotic medications for analgesia. Six high-income countries (HICs) account for 80% of the world's opioid consumption. Key drug control policies, organizations, and politics continue to influence issues of access and abuse, with disproportionately negative impacts for underserved populations.
- Critical shortages and the inequitable distribution of anesthesia providers are significant barriers to increasing access to safe anesthesia and surgical care. The density of surgery, anesthesia, and obstetric providers is 0.7 per 100,000 population for LICs as compared with 57 per 100,000 population for HICs.

KEY POINTS—cont'd

- Modern anesthesia workforce training and practice models vary widely from country to country. Innovative workforce solutions are needed to increase provider numbers while simultaneously ensuring quality and promoting access for underserved populations.
- Anesthesia, analgesia, and surgical services are feasible in resource-constrained settings and are as cost-effective as many other public health interventions (e.g., vaccinations).
- Issues of access, safety, and resource utilization are relevant to all anesthesia providers. Equipping anesthesia providers with knowledge and skills needed to address global challenges in anesthesia will become increasingly important in order to expand access to safe and affordable anesthesia care worldwide.
- Health care providers from multiple disciplines (nursing, surgery, obstetrics, anesthesia, and many more) are needed to effectively provide surgical and perioperative care. Anesthesiologists routinely work across the perioperative disciplines and can play a significant role to improve cohesive advocacy efforts and lead progress in global health equity for surgical disease and analgesia.
- The global anesthesia community is lagging behind other health disciplines in addressing global health challenges and must rapidly expand investment in initiatives to help characterize (research), address (implementation and policy), and support (financing) global anesthesia challenges.
- Developing infrastructure, expanding workforce, improving data to drive policy, providing financial risk protection mechanisms for surgical patients, improving referral and prehospital systems, and providing essential medicines are actions the global anesthesia community must prioritize. The need to act promptly is immense and must be balanced but not overshadowed by research agendas.

Introduction

There have been considerable efforts in recent years to define a global "standard" or "optimal" practice of anesthesia.[1-4] These debates, investigations, and innovations have most often been framed in the context of maximizing patient safety. More recently the focus of these efforts has expanded to also incorporate the important goals of maximizing not only safety, but also accessibility and affordability of anesthesia services.[5]

With scientific advancement and economic development, anesthesia—like much of medicine—has changed dramatically since the first public display of ether anesthesia in October of 1846. However, over the past 150-plus years, advances in anesthesia have been neither uniform nor universal, resulting in vastly heterogeneous anesthesia practice models and massive inequities in access to safe anesthesia care worldwide. The majority of the world's population does not have access to safe, affordable surgical, anesthesia, or pain services, and relatively few resources are being invested by governments, donors, or the global anesthesia community to address this crisis.

In this chapter we build off the work of Dr. Miller and colleagues' to explore not only the evolution and diversity of anesthesia practice models from around the world, but also challenges facing the global anesthesia community. A better understanding of the evolution of modern anesthesia care models, as well as the challenges they face and have overcome, is a key step to improving access and patient safety worldwide.

The first section of this chapter describes the scope and magnitude of the ongoing global surgical, anesthesia, and pain crises. This section also explores reasons why these crises have been relatively neglected by the global public health community, and reviews potential areas for intervention, advocacy, and change.

TABLE 2.1 World Bank Income Classifications by Gross National Income per Capita

	GNI per Capita (US $)
Low income	<1,005
Lower-middle income	1,006-3,955
Upper-middle income	3,956-12,235
High income	>12,235

GNI, Gross national income.
Source: https://blogs.worldbank.org/opendata/new-country-classifications-income-level-2017-2018.

The second section of this chapter presents examples of different anesthesia care models from around the world, including select historical milestones and snapshots of current challenges from regional and country-level perspectives.

The final section of this chapter provides a primer on essential clinical and nonclinical knowledge relevant for anesthesia practice in resource-constrained settings. The chapter concludes by discussing the role of anesthesia providers beyond the confines of the operating room or hospital setting, who increasingly will be called upon for solutions that increase access to safe anesthesia, surgery, and analgesia in the global context.

Section 1: Anesthesia and "Global Health"

The terms anesthesia and global health, when used together, often invoke thoughts of providers from high-income countries (HICs) providing clinical care in low- and middle-income countries (LMICs) as part of humanitarian outreach or "mission trips" (Table 2.1). Although such initiatives comprise a substantial proportion of efforts that

TABLE 2.2 Definitions of Global Health and Global Surgery

	Global Health*	Global Surgery†
Approach	Field of study, research, practice and advocacy. Emphasizes global perspective and a scientific approach to health promotion and disease prevention, including broad determinants of health.	Area for study, research, practice, and advocacy that places priority on improving health outcomes and achieving health equity for all people worldwide who are affected by surgical conditions or have a need for surgical care.
Geography	Focuses on issues that directly or indirectly affect health but that can transcend national boundaries.	Global surgery emphasizes supraterritorial and transnational issues, determinants, and solutions.
Level of cooperation	Development and implementation of solutions often require global cooperation.	Recognizes that the determinants of inadequate or inequitable surgical care are often the result of common and interdependent global structures and processes, and require global cooperation for global solutions.
Individuals or populations	Embraces both prevention in populations and clinical care of individuals.	Encompasses surgical care for underserved populations in all countries with special emphasis on those affected by conflict, displacement, and disaster.
Access to health	Health equity among nations and for all people is a major objective.	Equitable access to safe and affordable anesthesia, analgesia, and surgical care is a major objective.
Range of disciplines	Highly interdisciplinary and multidisciplinary within and beyond health sciences.	Incorporates all surgical specialties including obstetric and gynecological surgery, anesthesia, perioperative care, aspects of emergency medicine, rehabilitation, and palliative care, and nursing and the allied health professions involved in the care of the surgical patient. Engages non-clinical stakeholders including health economists, governments, and policymakers.

*Modified from Koplan JP, Bond TC, Merson MH, et al. Towards a common definition of global health. *Lancet*. 2009;(9679);1993–1995; Fried LP, Bentley ME, Buekens P, et al. Global health is public health. *Lancet*. 2010;375(9714):535–537.
†Modified from Dare AJ, Grimes CE, Gillies R, et al. Global surgery: defining an emerging global heath field. *Lancet*. 2014;384(9961):2245–2247.

aim to increase access to surgical and anesthesia services in resource-constrained settings, they represent only a fraction of the ever-expanding role of the anesthesia community in global health.

In this chapter, the term "global health" refers to a multidisciplinary field of study, research, practice, and advocacy that develops and implements solutions to promote health equity. Global health transcends national boundaries, requires global cooperation, and utilizes both population-level (e.g., injury prevention) and individual-level (e.g., clinical care) strategies (Table 2.2). Although some debate exists over the optimal definition of global health and its distinction, or lack thereof, from public health, it is worth highlighting that global health is not synonymous with international aid (i.e., going abroad from one's own country) or the transfer of technologies or interventions from HICs to LMICs.[6,7] Global health encompasses much more, including local providers working in the local environment (whether that is a low-, middle-, or high-income setting), and increasing emphasis on health equity.[8]

Global health has received unprecedented levels of interest in recent decades, expanding from its infectious disease origins to now incorporate a wider range of diseases, including the social and environmental factors affecting health.[9,10] Despite this expanded scope, surgery and anesthesia have remained relatively forgotten by the global health community.

In June of 1980, then Director-General of the World Health Organization (WHO), Dr. Halfdan Mahler, gave a presentation to the International College of Surgeons in Mexico City entitled "Surgery and Health for All." In this speech, Dr. Mahler stated that "*Surgery clearly has an important role to play in primary health care and in the services supporting it. Yet, the vast majority of the world's population has no access whatsoever to skilled surgical care, and little is being done to find a solution. I beg of you to give serious consideration to this most serious manifestation of social inequity in health care.*"[11]

Despite recognition of the global anesthesia and surgical crises several decades ago, it has been only recently that the global health community has begun to take notice and action.[12–17] In 2004, the WHO created the Emergency and Essential Surgical Care Program (EESC) and in 2005, the WHO Global Initiative for Emergency and Essential Surgical Care (GIEESC) was formed to convene multidisciplinary stakeholders interested in surgical disease. In 2007, the Bellagio Essential Surgery Group and Burden of Surgical Disease Working Group (later renamed the Alliance for Surgery and Anesthesia Presence [ASAP]) formed as two of the earliest concerted efforts to raise international awareness for surgical disease by advocating for the integration of surgery into health systems and the promotion of research and collaboration across disciplines.[18] These efforts followed in the wake of a seminal chapter on surgery in the Second Edition of the Disease Control Priorities in Developing Countries (DCP2) book in 2006.[19] In 2008, the WHO launched the Safe Surgery Saves Lives initiative along with the WHO Safe Surgery Checklist.[20,21] Also in 2008 multiple leaders in global health highlighted surgery as the "neglected stepchild" and as the "other neglected disease" in global health, drawing comparison with the then emerging term, "neglected tropical diseases."[22,23]

Despite these pleas and consistent, albeit limited, data demonstrating the massive scale of the surgical disease crisis, it was not until 2014–15 that greater attention began to be realized. In 2014, the Amsterdam Declaration on Essential Surgical Care was created, and in 2015, the 68th World Health Assembly (WHA) unanimously passed resolution 68.15 (WHA68.15) to strengthen emergency and essential

BOX 2.1 Key Messages From the Disease Control Priorities 3rd Edition

- Provision of essential surgical procedures would avert an estimated 1.5 million deaths a year, or 6%-7% of all avertable deaths in low- and middle-income countries (LMICs).
- Essential surgical procedures rank among the most cost-effective of all health interventions. The surgical platform of first-level hospitals delivers 28 of the 44 essential procedures, making investment in this platform also highly cost-effective.
- Measures to expand access to surgery, such as task-sharing, have been shown to be safe and effective while countries make long-term investments in building surgical and anesthesia workforces.
- Because emergency procedures constitute 23 of the 28 procedures provided at first-level hospitals, such facilities must be widely geographically available.
- Substantial disparities remain in the safety of surgical care, driven by high perioperative mortality rates and anesthesia-related deaths in LMICs. Feasible measures, such as the World Health Organization's (WHO's) Surgical Safety Checklist,[27a] have led to improvements in safety and quality.
- The large burden of surgical conditions, the cost-effectiveness of essential surgery, and the strong public demand for surgical services suggest that universal coverage of essential surgery (UCES) should be financed early on the path to universal health coverage.
- We point to estimates that full coverage of the component of UCES applicable to first-level hospitals would require slightly more than $3 billion annually of additional spending and yield a benefit to cost ratio of better than 10:1. It would efficiently and equitably provide health benefits and financial protection, and it would contribute to stronger health systems.

From Jemison DT, Alwan A, Mock CN, et al: Universal health coverage and intersectoral action for health: key messages from Disease Control Priorities, 3rd edition. The Lancet 391, Issue 10125, 2018:1108–1120.

BOX 2.2 Key Messages From The Lancet Commission on Global Surgery

- 5 billion people do not have access to safe, affordable surgical and anesthesia care when needed. Access is worst in low-income and lower-middle-income countries (LMICs), where 9 of 10 people cannot access basic surgical care. 143 Million additional surgical procedures are needed in LMICs each year to save lives and prevent disability. Of the 313 million procedures undertaken worldwide each year, only 6% occur in the poorest countries, where over a third of the world's population lives. Low operative volumes are associated with high case-fatality rates from common, treatable surgical conditions. Unmet need is greatest in eastern, western, and central sub-Saharan Africa, and South Asia.
- 33 Million individuals face catastrophic health expenditure due to payment for surgery and anesthesia care each year. An additional 48 million cases of catastrophic expenditure are attributable to the nonmedical costs of accessing surgical care. A quarter of people who have a surgical procedure will incur financial catastrophe as a result of seeking care. The burden of catastrophic expenditure for surgery is highest in low-income and lower-middle-income countries and, within any country, lands most heavily on poor people.
- Investing in surgical services in LMICs is affordable, saves lives, and promotes economic growth. To meet present and projected population demands, urgent investment in human and physical resources for surgical and anesthesia care is needed. If LMICs were to scale-up surgical services at rates achieved by the present best-performing LMICs, two thirds of countries would be able to reach a minimum operative volume of 5000 surgical procedures per 100,000 population by 2030. Without urgent and accelerated investment in surgical scale-up, LMICs will continue to have losses in economic productivity, estimated cumulatively at US$12.3 trillion (2010 US$, purchasing power parity) between 2015 and 2030.
- Surgery is an "indivisible, indispensable part of health care."[1] Surgical and anesthesia care should be an integral component of a national health system in countries at all levels of development. Surgical services are a prerequisite for the full attainment of local and global health goals in areas as diverse as cancer, injury, cardiovascular disease, infection, and reproductive, maternal, neonatal, and child health. Universal health coverage and the health aspirations set out in the post-2015 Sustainable Development Goals will be impossible to achieve without ensuring that surgical and anesthesia care is available, accessible, safe, timely, and affordable.

Mock CN, Donkor P, Gawande A, et al: Essential surgery: key messages from Disease Control Priorities, 3rd edition. The Lancet 385, Issue 9983, 2015: 2209–2219.

surgical and anesthesia care as a component of universal health coverage.[24,25] Also in 2015, publication of DCP3 and the Lancet Commission on Global Surgery (LCOGS) "Global Surgery 2030" report significantly expanded the body of data characterizing the global surgical and anesthesia crises, and also outlined strategies for addressing some of these challenges (Boxes 2.1and 2.2).[5,26] During the LCOGS development, Jim Kim, President of the World Bank, echoed the words of Dr. Mahler from 35 years earlier by stating, "…surgery is an indivisible, indispensable part of health care and of progress towards universal health coverage."[27]

These events provided a much needed boost to efforts aimed at improving the accessibility, affordability, and safety of surgical, obstetric, and anesthesia care worldwide. They also helped provide a framework for including surgery and anesthesia as global health priorities by linking surgery and anesthesia care to universal health coverage. Surgery and anesthesia were not included in previous priority-setting efforts, in part, because it was not clear how to incorporate them. Limited data about the scale of the crises, as well as misperceptions around complexity and cost-effectiveness (as discussed in the next section) resulted in surgery and anesthesia care being peripheral to global health priority-setting efforts like the Millennium Development Goals (MDGs). Although surgery and anesthesia are not explicitly a focus of more recent global health priority initiatives like the Global Health 2035 report and the United Nations (UN) Sustainable Development Goals (SDGs), these reports emphasize noncommunicable diseases, injuries, healthcare workforce expansion, and universal health coverage, which incontrovertibly depend on surgery and anesthesia.[28,29]

Milestones like LCOGS, the WHA resolution 68.15, and the Lancet Commission on Palliative Care and Pain Relief have helped call attention to the global anesthesia, analgesia, and surgery crises at hand.[30] Entities like the World Federation of Societies of Anaesthesiologists (WFSA), Association of Anesthetists of Great Britain and Ireland (AAGBI), Canadian Anesthesiologists' Society International Education Foundation (CASIEF), and Lifebox are among the increasing

number of anesthesia organizations working on system-level changes, research, and large-scale education initiatives in LMICs. Many national anesthesia societies, such as the United Kingdom's Royal College of Anaesthetists (RCoA), the Royal College of Anesthesiologists of Thailand, and the Chilean Society of Anesthesiologists are also actively engaged in such activities. The number of these global anesthesia efforts is unprecedented, but still nascent and evolving.

If surgery is described as the neglected step-child of global health, then anesthesia is the forgotten relative. Despite significant interdependence, surgery, anesthesia, and obstetrics have yet to harmonize global health efforts and maximize impact. Global health efforts involving either surgery or anesthesia have become known collectively as "global surgery" (see Table 2.2). In 2014, "global surgery" was defined "…as an area for study, research, practice, and advocacy that places priority on improving health outcomes and achieving health equity for all people worldwide who are affected by surgical conditions or have a need for surgical care. Global surgery incorporates all surgical specialties, including obstetric and gynecologic surgery; anesthesia; perioperative care; aspects of emergency medicine; rehabilitation; palliative care; and nursing and the allied health professions involved in the care of the surgical patient. It encompasses surgical care for underserved populations in all countries and for populations affected by conflict, displacement, and disaster, and promotes access to safe, quality care. Global surgery emphasizes supraterritorial and transnational issues, determinants, and solutions, recognizing that the determinants of inadequate or inequitable surgical care are often the result of common and interdependent global structures and processes, even though they are predominantly experienced within individual countries and communities.[31]" This definition was abbreviated to state "global surgery is an area of study, research, practice, and advocacy that seeks to improve health outcomes and achieve health equity for all people who require surgical care, with a special emphasis on underserved populations and populations in crisis. It uses collaborative, cross-sectoral, and transnational approaches and is a synthesis of population-based strategies with individual surgical care." Although anesthesia is not directly mentioned in this definition, "global surgery" has become a rallying point for anesthesia global health efforts.

SCOPE AND SCALE OF THE GLOBAL ANESTHESIA, SURGERY, AND PAIN CRISES

Global Burden of Surgical Disease

Nearly 30% of global morbidity and mortality is surgically treatable, with tens of millions of lives lost each year due to surgical conditions.[5] This burden of surgical disease predominantly affects LMICs and kills 4 times more people than human immunodeficiency virus (HIV), TB, and malaria combined (Fig. 2.1).[32] In addition to negative impacts on health and well-being, there is also significant economic burden associated with surgical morbidity and mortality. By 2030, morbidity and mortality from surgical conditions could reduce annual gross domestic product (GDP) growth by an estimated 2% in LMICs. In the past, similar calculations were used to successfully generate global investment in malaria, but had estimated much lower (1.3%) decreases in GDP due to malaria.[33] Without significant and immediate intervention, surgical disease will produce economic productivity losses of more than US$12 trillion for LMICs between 2015 and 2030. While it is generally agreed that surgical conditions account for a large proportion of global morbidity and mortality, precise data to support this have been lacking. This challenge has been attributed in part to a lack of resources being invested in such research and also to several inherent difficulties in quantifying surgical diseases.

The term "global burden of disease" (GBD) uses the disability-adjusted-life-year (DALY) as a unit to quantify premature death (years of life lost) and disability (years of life lived in a state of less than full health) (Fig. 2.2). The DALY was originally developed for the seminal GBD 1990 Study to quantify the burden of different diseases around the world and has since become commonly used in public health and health economics.[34,35] Because the DALY is routinely used to inform resource allocation, it has been utilized to describe surgical and pain disease burdens as well. The global health community has moved away from using terms such as third world, developed, or developing when describing countries' level of economic development. Leading causes of DALYs are often reported geographically by World Bank income level (see Table 2.1) or more recently by socio-demographic index (SDI) (Figs. 2.3 and 2.4). The SDI is a composite average of three indicators predictive of health outcomes: income per capita, average educational attainment (for population >15 years old), and total fertility rate.

The 2006 DCP2 publication was one of the first attempts to quantify surgical disease burden and did so by asking 18 surgeons for an educated guess, using convenience sampling and an online survey. Although the reported number

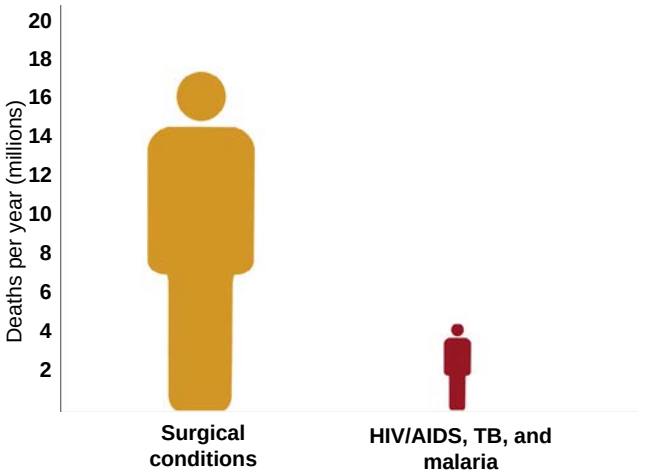

Fig. 2.1 Surgical conditions account for more annual deaths (16.9 million) than HIV/AIDS (1.03 million), TB (1.21 million), and malaria (0.72 million) combined. *AIDS*, Acquired immunodeficiency syndrome; *HIV*, human immune virus, *TB*, tuberculosis. (Data from Shrime MG, Bickler WS, Alkire BC, et al. Global burden of surgical disease: an estimation from the provider perspective. *Lancet Glob Health.* 2015;3:S8–S9; and GBD collaborators 2016. Global, regional, and national age-sex specific mortality for 264 causes of death, 1980–2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet.* 2017;390[10100]:1151–1210.)

Fig. 2.2 The disability-adjusted life year *(DALY)*. (From Wikipedia. https://en.wikipedia.org/wiki/Disabilityadjusted_life_year#/media/File:DALY_disability_affected_life_year_infographic.svg. Creative commons license: CC BY-SA 3.0.)

(11%) was eye-opening and widely quoted, it was likely a significant underestimation.

In 2015, the DCP3 provided another attempt to assess the public health impact of surgical care by estimating morbidity and mortality averted by scaling up basic surgical and anesthesia services in LMICs (i.e., surgical care for appendicitis, paralytic ileus, intestinal obstruction, hernias, gallbladder and bile duct disease, maternal hemorrhage, obstructed labor, abortion and neonatal encephalopathy, trauma resuscitation, surgical airway, peripheral venous access, suturing, laceration and wound management, chest tube or needle decompression, fracture reduction, escharotomy, fasciotomy, skin grafting, and trauma-related laparotomy and amputation). They concluded that an estimated 1.4 million deaths and 77.2 million DALYs could be prevented each year by scaling up basic surgical and anesthesia services in LMICs.[26]

The LCOGS produced another attempt to estimate global morbidity and mortality from surgical disease by asking 173 surgeons, anesthesiologists, internists, nurses, and public health practitioners from around the world, "What proportion of patients with the following conditions would, in an ideal world, require a surgeon for management?" The result of this survey was 28% to 32% of overall GBD requires a surgeon for management. Based on these results, LCOGS estimated that 30% of GBD is surgically treatable with an estimated 17 million lives lost per year due to surgical conditions.[5]

These reports are consistent with the 1990 GBD Study data, which demonstrate that the morbidity and mortality associated with surgical diseases is significantly larger than that of HIV, TB, and malaria combined.[32] Unintentional injuries are the single largest contributor of DALYs worldwide. The majority of deaths that can be prevented with surgical care are due to injuries (77%), maternal-neonatal

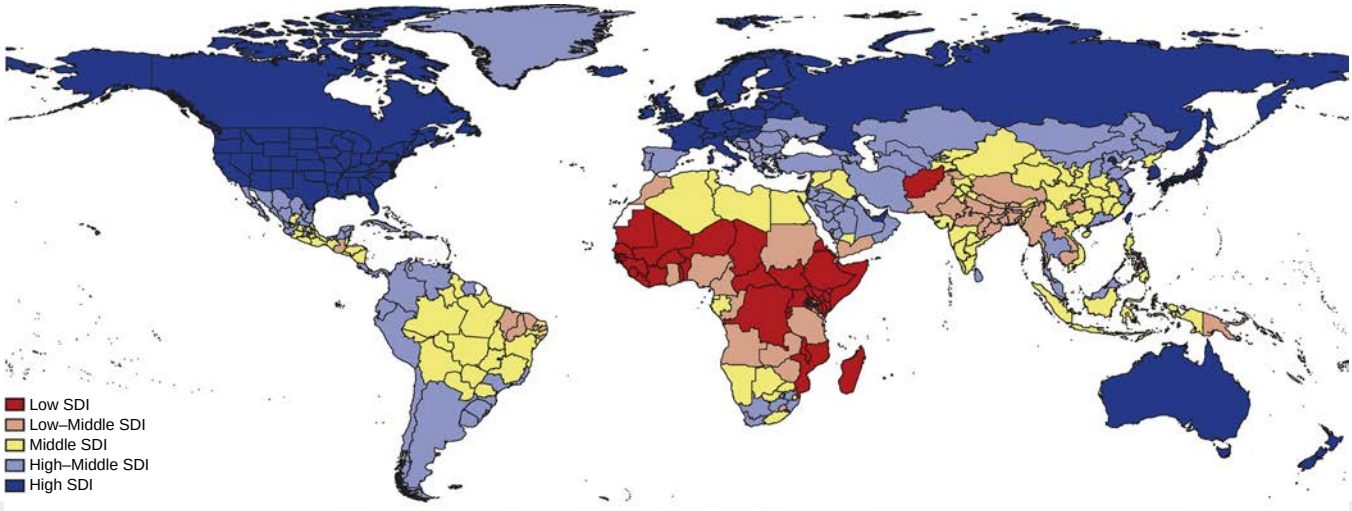

Fig. 2.3 Socio-demographic Index *(SDI)* is calculated for each geography as a function of lag-dependent income per capita, average educational attainment in the population older than age 15 years, and the total fertility rate. SDI units are interpretable; a zero represents the lowest level of income per capita and educational attainment and highest total fertility rate observed during 1980–2015, whereas a one represents the highest income per capita and educational attainment and lowest total fertility rate observed in the same period. Cutoffs on the SDI scale for the quintiles have been selected on the basis of examination of the entire distribution of geographies 1980–2015. *GBD,* Global Burden of Disease. (From GBD 2015 Mortality and Causes of Death Collaborators. Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980–2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet*. 2016;388[10053]:1459–1544. Copyright © 2017 The Author[s]. Published by Elsevier Ltd. This is an Open Access article under the CC BY 4.0 license.)

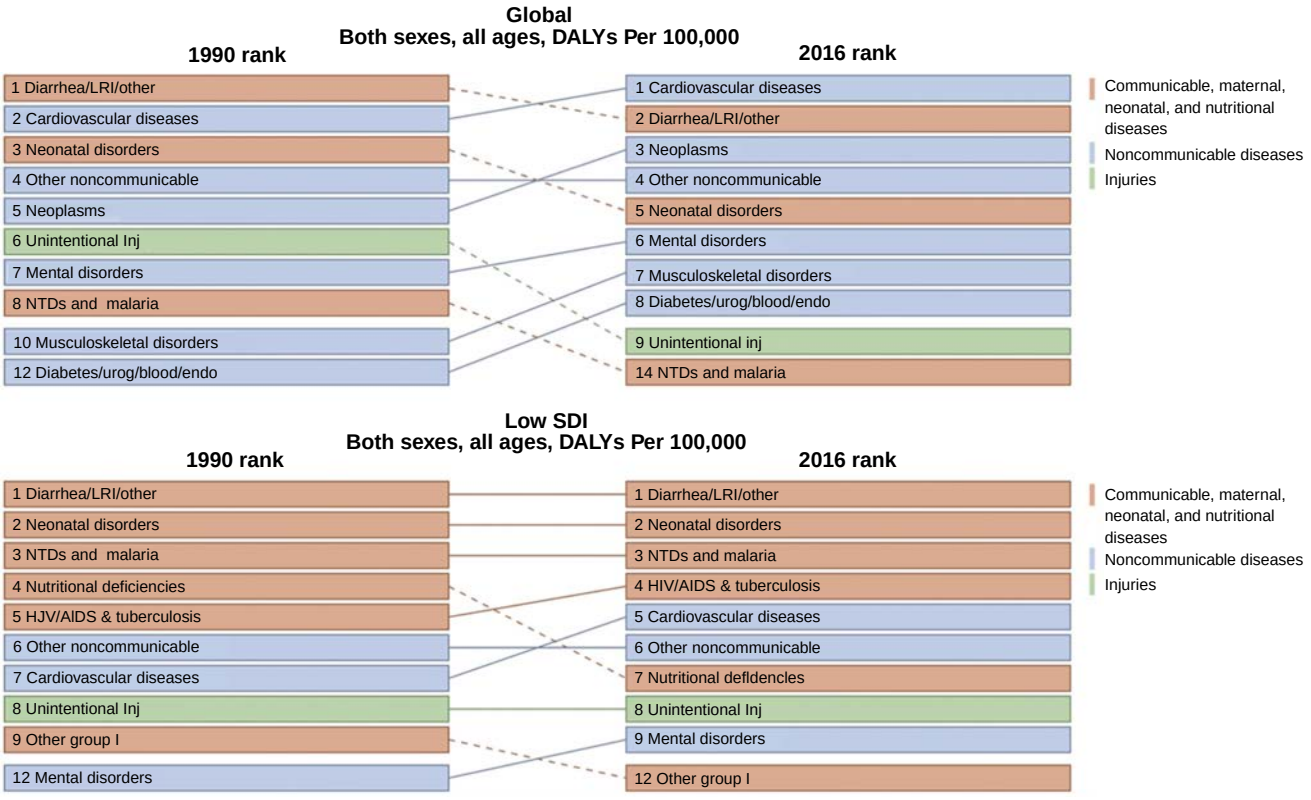

Fig. 2.4 Leading causes of death and disability-adjusted-life-years *(DALYs)*, 1990–2016, global versus low Socio-Demographic Index *(SDI)*. *AIDS*, Acquired immunodeficiency syndrome; *HIV*, human immune virus. (From https://vizhub.healthdata.org/gbd-compare/. Reproduced under Creative Commons Non-Commercial-No Derivatives 4.0 International License.)

conditions (14%), and digestive diseases (9%).[26] Global industrialization and an "epidemiological transition" (i.e., people living longer) in many LMICs have resulted in rising noncommunicable disease and injury burdens (most notably from road traffic crashes) that will likely contribute to increased global surgical disease burden in the coming years.

Each of the methods previously described to estimate surgical disease burden is imperfect. Challenges and limitations include complex methodologies (e.g., Institute for Health Metrics and Evaluation [IHME], GBD Studies), difficulty with measuring and defining surgical diseases (e.g., the same neoplasm in one person may be treated with surgery but in another person may be treated with chemotherapy), and challenges in assigning DALYs to diseases (i.e., disability weighting) and assigning DALYs averted to surgical procedures.[26] To overcome these shortcomings, additional metrics for global surgery and anesthesia have been proposed and include measuring disease prevalence, treatment backlogs for non fatal conditions, morbidity and mortality as a result of delays in care, social benefit, economic benefit, and value of a statistical life (rather than costs per DALY averted).[36]

One significant role for the academic anesthesia community in the global context is working to increase efforts that better quantify the growing surgical disease and pain burdens in order to facilitate appropriate resource allocation and subsequent evaluation of interventions.

Global Burden of Pain

As with surgical disease burden, there is general consensus on the staggering prevalence and incidence of pain worldwide though there are relatively limited data and significant challenges to quantifying pain burden in the global context. Pain is one of the most common reasons for seeking medical attention, is among the top five causes of DALYs worldwide, and directly accounts for four (low back pain, neck pain, musculoskeletal pain, migraine) of the top 10 causes of years lived with disability (YLDs).[32,37] These statistics do not even account for pain secondary to oncology, injury, or postoperative etiologies, which likely increase these numbers substantially. It is estimated that 10% to 25% of the world's population suffer from recurring and chronic pain, with increasing numbers caused by intentional physical harm such as war, violence, and torture.[38] Uncontrolled pain has many potential negative impacts on health, well-being, and economic productivity, including increased risk of myocardial infarction and chronic pain.

The 2017 Lancet Commission on Palliative Care and Pain Relief defined serious health-related suffering (SHS)

as suffering associated with illness or injury that compromises physical, social, or emotional functioning, and cannot be relieved without medical intervention.[30] Approximately half of all deaths worldwide involve SHS and more than 80% of people who die with SHS are from LMICs. It is estimated that 2.5 million children die with SHS each year. Ninety-eight percent of these children live in LMICs, and more than 90% of these deaths are avoidable. Among the top 10 conditions associated with SHS are HIV, malignancy, and injury. Though not as obvious as injury or cancer, HIV/AIDS is a major source of pain and analgesia need.[39] Pain related to HIV is not routinely managed by anesthesiologists when compared to other more common pain etiologies, however, the relevance of HIV as a rallying point to advocate for greater access to analgesics in LMICs is discussed further in this chapter. In many countries, conditions such as diabetes, sickle cell, and leprosy are also responsible for significant pain burdens. With increasing longevity and industrialization, the disease burden for malignancy and injury are expected to increase significantly in LMICs. As providers with often the most experience administering analgesics, anesthesia providers play an expanded and critical role in pain management, especially in resource-constrained settings.

Disparities in Access, Affordability, and Safety

The exact level of disease burden attributable to surgical disease or pain is a focus of ongoing debate and research, yet it is generally accepted that the surgical, anesthesia, and pain crises are massive, largely avoidable, and disproportionately affect LMICs. Of the roughly 300,000 maternal deaths worldwide, 99% occur in low-resource settings (66% in sub-Saharan Africa) and the majority are preventable with relatively basic surgical, anesthesia, and perioperative care.[40] Approximately 70% of global cancer deaths occur in LMICs, with the majority requiring surgical, anesthesia, or analgesia services.[41] Scaling access to basic surgical and anesthesia services in LMICs could avert 77 million DALYs and 1.5 million deaths per year.[26] Injury represents the majority (77%) of this avoidable morbidity and mortality, followed by maternal and neonatal conditions (14%). Approximately 90% of deaths and DALYs that are lost due to road traffic accidents occur in LMICs.

Based solely on the inequitable distribution of operating theatres, more than two billion people have no access to surgical services.[42] When also accounting for timeliness, facility capacity, safety, and affordability, nearly 5 billion people—the majority of the world's population—lack access to surgical and anesthesia care. The Global Initiative for Children's Surgery (GICS) estimates that 1.7 billion children lack access to surgical care.[42a] It is estimated that approximately 143 million additional surgeries are required each year.[5] Of the 234 million major surgical procedures performed annually, only 3% to 6% of them are estimated to occur in LIMCs.[5,43] Disparities in access disproportionally affect lower-income areas like sub-Saharan Africa or South Asia, where more than 95% of the population do not have access to surgical and anesthesia care. In some higher-income areas like North America and Europe, access varies considerably, but generally more than 95% of the population has access (Fig. 2.5).[44] Even in HIC like the United States, access to anesthesia, surgical, and analgesia care can be limited for rural and underserved populations.[45,46] It is estimated that universal access to "essential" surgical procedures (which include treatments for injury, obstetric complications, abdominal emergencies, cataracts, and congenital anomalies) would prevent approximately 1.5 million deaths per year or 6% to 7% of all preventable deaths in LMICs.[26]

Inadequate access to analgesia is among the most neglected and inequitable global public health challenges. The global burden of pain disproportionately affects the world's poor due to the high-burden conditions associated with pain (e.g., HIV, malignancy, and injury) in LMICs, and the general lack of access to analgesics. Although pain is the most common reason for seeking medical attention, and analgesia is considered a basic human right, gaps in access to analgesia are significant and among the most striking global health disparities worldwide.[47–49] Injury and malignancy, two conditions with significant analgesia needs, represent a significant proportion of surgical disease burden in LMICs, yet the vast majority of LMIC populations have limited or nonexistent access to opiate analgesia. Six HICs account for 80% of the world's opiate consumption, and countries that contain 17% of the world's population (Canada, United States, Western Europe, Australia, and New Zealand) are responsible for 92% of the world's opiate consumption (Figs. 2.6 and 2.7).[30,50-52] Pain and palliative care remain relatively neglected by the global health community and disproportionately affect vulnerable populations in LMICs.[30,53] In recent decades, access to opiates has improved in some LMICs, but not all (e.g., consumption in Africa and South Asia has declined).[52] Inequitable access to analgesia is not unique to LMICs and has been repeatedly described in many HICs, including the United States.[54-56] Reasons for the inequitable distribution of analgesia are discussed further in the next section of this chapter.

For the proportion of the world's population that has access to surgical and anesthesia care, they must confront significant disparities in safety. In the last half-century perioperative patient safety has improved by more than 10-fold, though the majority of the gains have been seen in HICs.[57] In the United States during the 21st century, anesthesia-related mortality decreased from 1:1560 around 1950 to less than 1:13,000, and is significantly better than this in healthy patients.[58,59] Worldwide, approximately 32 million people per year receive anesthesia without adequate monitoring, and more than 77,000 operating rooms (19%) worldwide lack pulse oximetry. In some regions, more than 70% of operating rooms lack pulse oximetry.[42] Data on surgical outcomes in LMICs remain limited but have expanded significantly in the early part of the 21st century. Reports of perioperative mortality rates (POMRs) from low-income countries (LICs) have varied widely in both methodology and results, ranging from 0.2% to 6% overall, with significantly higher mortality for emergent procedures (10% overall, 20% for typhoid intestinal perforations).[60–64] One international, prospective, observational cohort study of adults undergoing inpatient surgery in 247 hospitals from 25 African countries reported a 30-day in-hospital mortality rate (2.1%) that was twice the reported global average, despite a significantly younger and lower American Society of Anesthesiologists (ASA) physical classification patient population.[65]

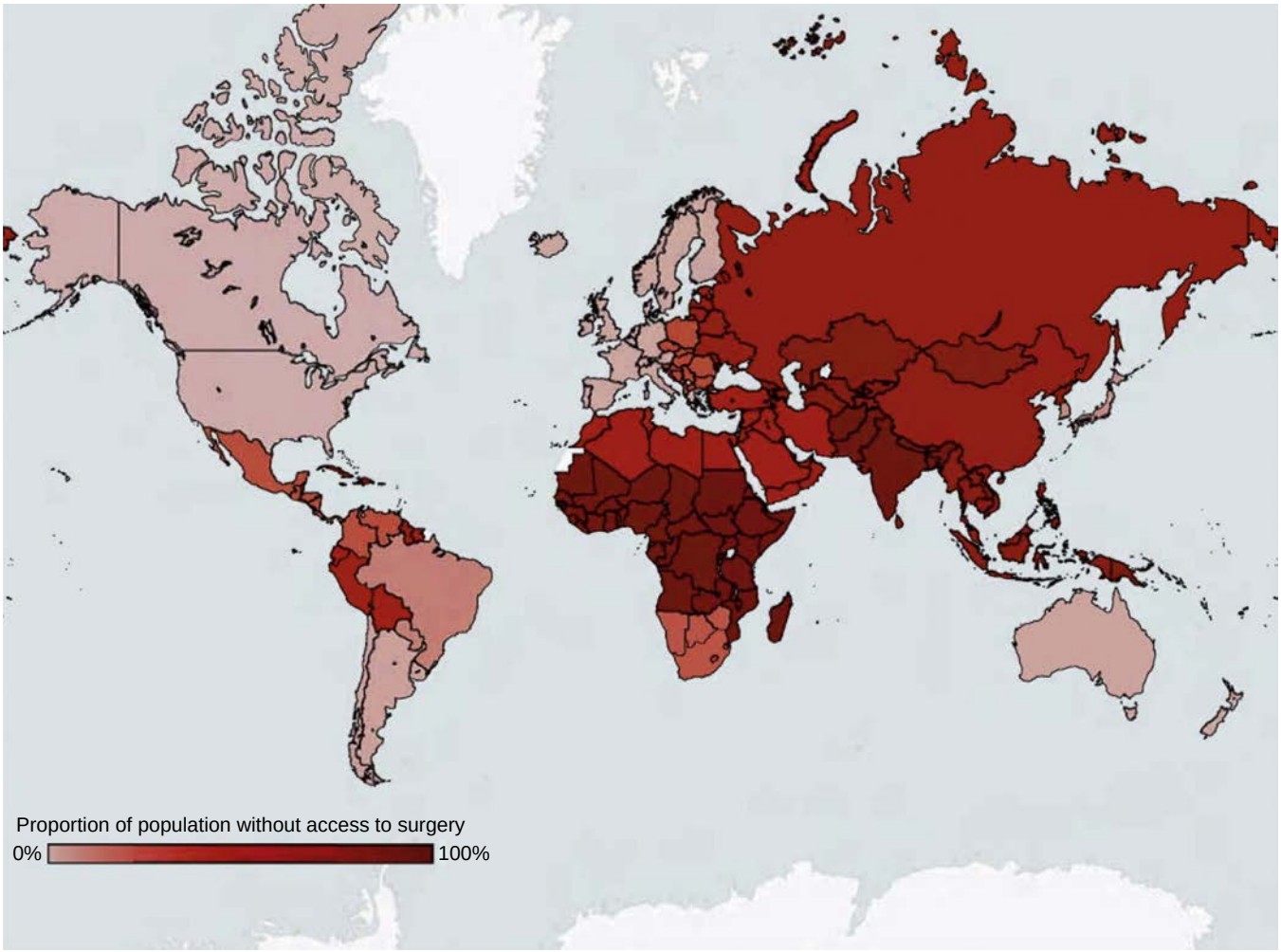

Fig. 2.5 The proportion of population without access to surgery. (From Alkire BC, Raykar NP, Shrime MG, et al. Global access to surgical care: a modelling study. *Lancet Glob Health*. 2015;3:e316–e323. doi: 10.1016/S2214-109X(15)70115-4. Epub 2015 Apr 27. Copyright © 2015 Alkire et al. Open Access article distributed under the terms of CC.)

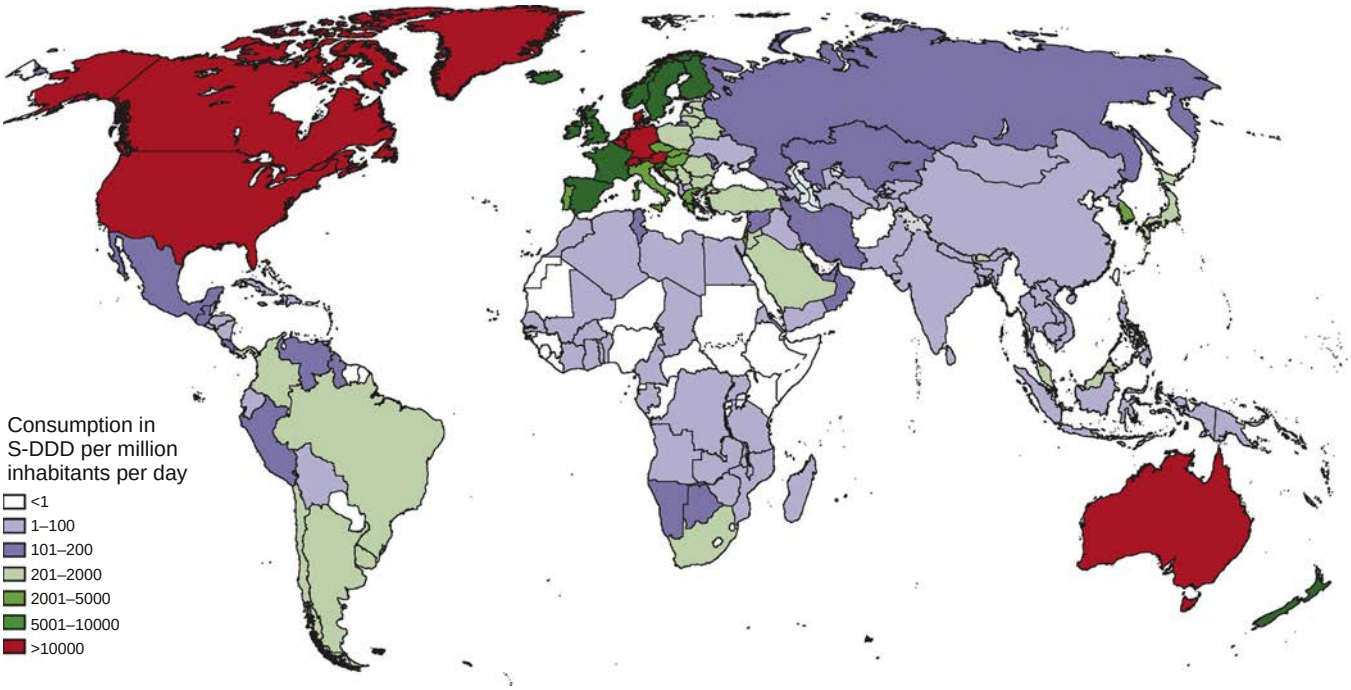

Fig. 2.6 Mean availability of opioids for pain management in 2011–2013. *S-DDD*, Defined daily doses for statistical purposes. (From Berterame S, Erthal J, Thomas J, et al. Use of and barriers to access to opioid analgesics: a worldwide, regional, and national study. *Lancet*. 2016;387:1644–1656. https://doi.org/10.1016/S0140-6736[16]00161-6. Copyright © 2015 Berterame et al. Open Access article distributed under the terms of CC.)

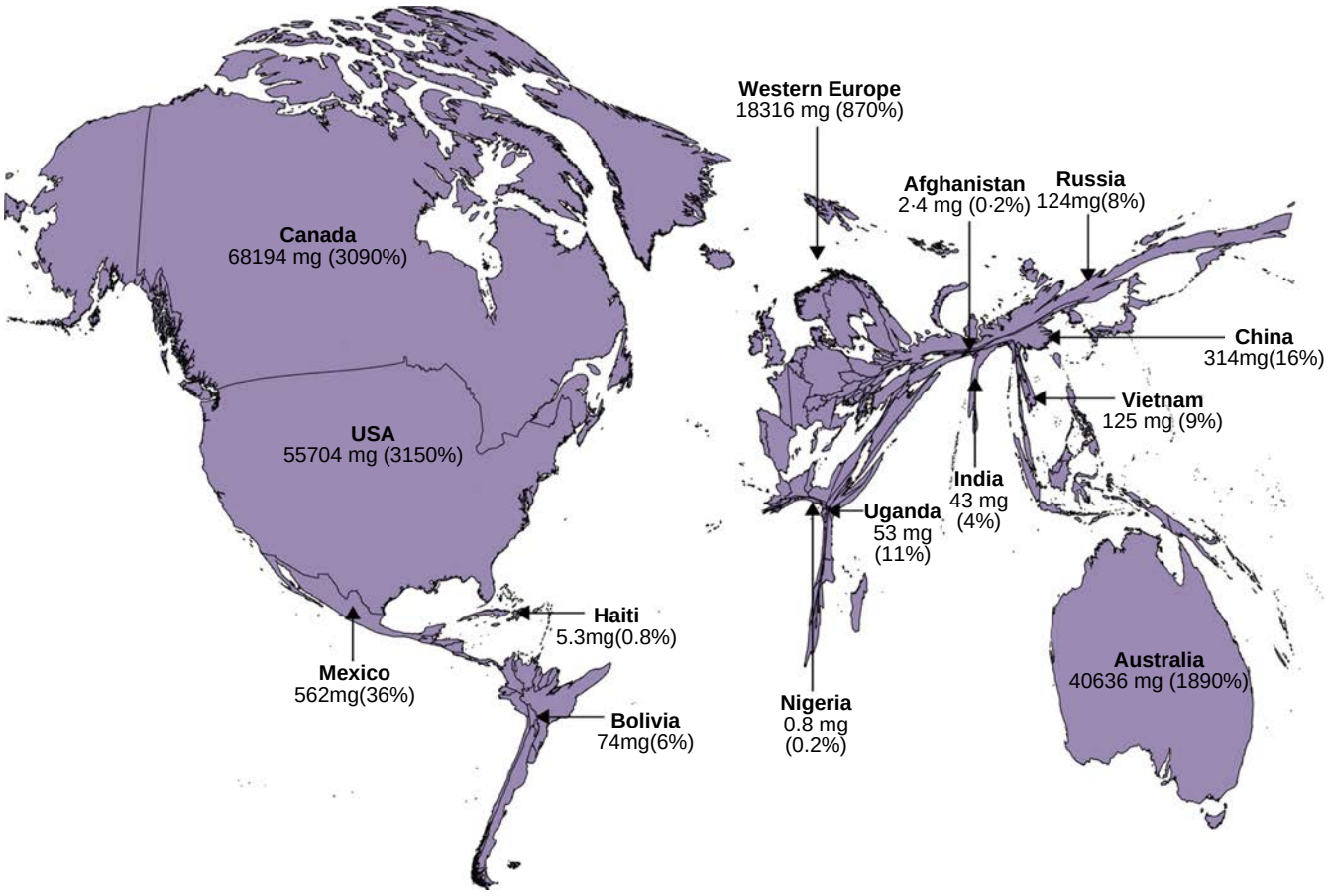

Fig. 2.7 Distributed opioid morphine-equivalent (morphine in mg/patient in need of palliative care, average 2010–2013), and estimated percentage of need that is met for the health conditions most associated with serious health-related suffering. (From Knaul FM, Bhadelia A, Rodriguez NM, et al. The *Lancet* Commission on Palliative Care and Pain Relief—findings, recommendations, and future directions. *Lancet Glob Health*. 2018;6:S5–S6. Copyright © 2018 The Author(s). Published by Elsevier Ltd. This is an open access article under the CC BY 4.0 license.)

In several African countries, anesthesia-related mortality has been reported to be in the 1:100s (Malawi 1:504; Zimbabwe 1:482; Nigeria 1:387 for C-sections; Togo 1:133 to 1:250).[66–69] In one report of 24-hour surgical outcomes in Togo, 30 deaths occurred (total cases 1464), 22 were deemed avoidable, and 11 were due to avoidable anesthesia complications.[15] Another report from Togo reported a mortality rate of 1:250 and found less than half of the 26 facilities surveyed had pulse oximetry, and none had capnography.[70] In a national report on maternal mortality in South Africa, nearly 2.35% of recorded maternal mortalities were anesthesia related, and the majority (93%) were deemed avoidable. One of the most common causes of anesthesia death in this report was the provision of spinal anesthesia without skills necessary to manage an airway or convert to general anesthesia.[71] Other commonly cited causes of avoidable anesthesia mortality in resource-constrained settings include inadequate staffing, monitoring, and drug overdose. A recent meta-analysis of anesthesia-related maternal mortality in LMICs found the risk of death from anesthesia for women undergoing obstetric procedures to be 1.2 per 1000 (vs. 3.8 per million in the United States), with higher risk reported if general anesthesia was used or if anesthesia was provided by a nonphysician[72]. In this analysis, anesthesia was the cause in 2.8% of maternal deaths in LMICs and 13.8% of all deaths during or after C-section in LMICs. To state this differently, anesthesia-related maternal mortality is 300-fold higher for neuraxial and 900-fold higher for general anesthesia than is reported in the United States.

It is important to note that the relationship between hospital-based perioperative morbidity and mortality and surgical disease morbidity and mortality must be interpreted with caution in settings where patients lack access to hospitals. In other words, in an HIC a patient's chances of dying from a ruptured viscous are roughly the same as the chances of dying from surgery for a ruptured viscous because more than 95% of the population has access to care. However, in an LIC, while the perioperative mortality for a ruptured viscous may be 10%, the majority of patients with this condition never make it to surgery and have mortality rates that are dramatically higher.

Affordability is another significant barrier to accessing surgical and anesthesia services. Each year, approximately 33 million people face catastrophic out-of-pocket expenditure due to payment for surgery and anesthesia (Fig. 2.8) with an additional 48 million people facing catastrophic expenditure related to non medical costs of accessing surgical care (e.g., transportation, lodging, and food).[5,73] Nearly half (3.7 billion) of the world's population is at risk of catastrophic expenditure if they were to have surgical and anesthesia care. The majority of those at risk live in

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